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Simultaneous Source Separation Using Wave Field Modeling and PEF Adaptive Subtraction

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SUMMARY

The acquisition of n-shots, more or less simultaneously, increases acquisition efficiency and collects a wider range of information for imaging and reservoir characterisation. Its success relies critically on the ability to separate n-shots from one recording. Using a difficult data example we show that a PEF-based adaptive subtraction of the estimated wavefield due to a secondary source provides an effective separation of the sources.

There are a number of potential advantages in being able to acquire 2 or more shots in the time that it normally takes to acquire 1 conventional shot. An obvious benefit is an increase in time and/or cost efficiency. If there is freedom to locate the additional source(s) at different locations relative to the main seismic vessel, then data may be simultaneously acquired which supplements the typical seismic configuration. Therefore such a technique can be used generally to increase source sampling, azimuth range, and offsets. In addition it can be used to increase the time value of data by reducing the need for infill or allowing an acquisition program to be completed sooner. Obviously, unless separation can be achieved to a sufficiently high degree, the enormous potential benefits of simultaneous sources remain unrealized. We consider the simultaneous source separation problem as the separation of 2 superposed coherent wave fields. Given a reasonable estimate of one of the source wave fields, a prediction error filter (PEF) based subtraction is used to determine the other wave field. This bears many similarities to the adaptive subtraction of multiples in multiple attenuation. We illustrate this technique using a very demanding dataset acquired in the Gulf of Mexico.

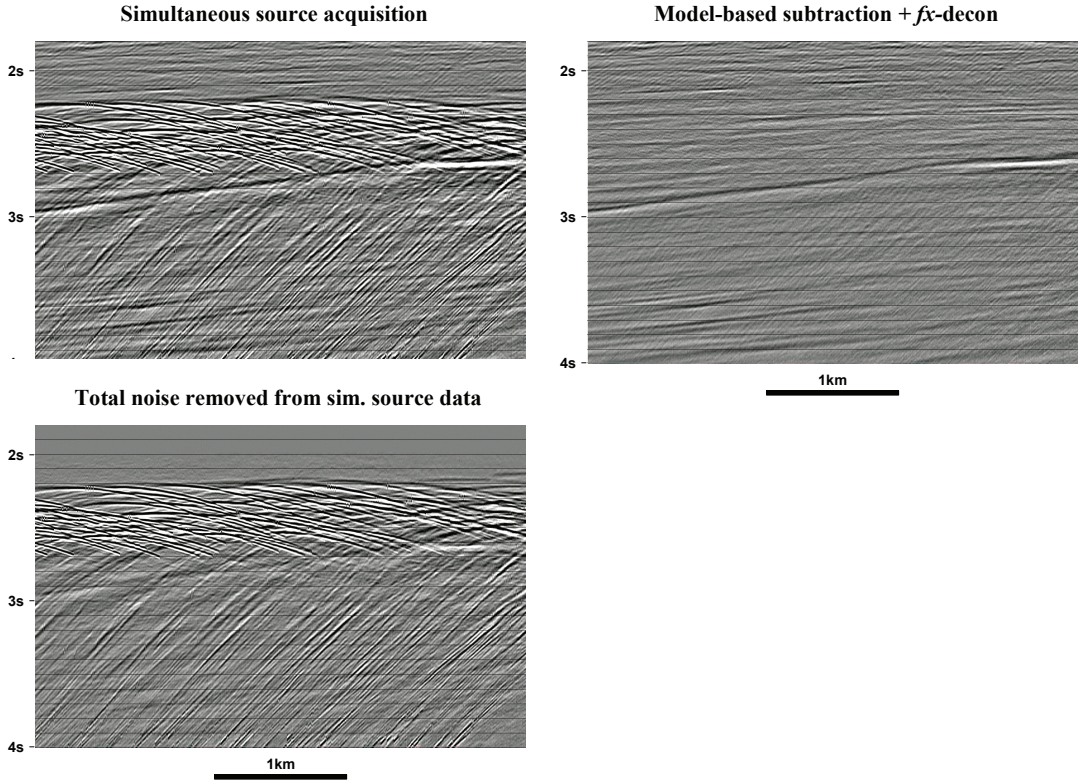

Figure 1. Stacks pertaining to the main source. Above on the left: the CMP stack of the simultaneously acquired data. Above on the right: the CMP stack after separation of the. Below: the stacked removed coherent noise due to the secondary source.